

Homework 9

1. (10 points) Show that $J_q^\mu = \bar{u}_u \gamma^\mu \frac{1}{2} (1 - \gamma^5) u_d = \bar{u}_{u,L} \gamma^\mu u_{d,L}$, where

$$u_L = \frac{1}{2} (1 - \gamma^5) u$$

2. (10 points) Through the π^+ and π^0 decay modes estimate the observed relative rates of Lepton Flavor violating processes.

3. (10 points optional) Draw the cascading decay of the τ^- till the e^- .

4. (20 points optional) Calculate the total decay rate of μ^- .

In the derivation use the relation :

$$\begin{aligned} & \text{Tr}[\gamma^\mu (1 - \gamma^5) \hat{p}_1 \gamma^\nu (1 - \gamma^5) \hat{p}_2] \text{Tr}[\gamma_\mu (1 - \gamma^5) \hat{p}_3 \gamma_\nu (1 - \gamma^5) \hat{p}_4] \\ &= 256 (\mathbf{p}_1 \cdot \mathbf{p}_3) (\mathbf{p}_2 \cdot \mathbf{p}_4), \end{aligned}$$

where $\hat{p} = \mathbf{p}_\sigma \gamma^\sigma$